California Influenza and Respiratory Disease Surveillance Report 2010-11 Season (October 3, 2010–May 21, 2011)

Background

The California Department of Public Health (CDPH) conducts statewide influenza surveillance, which includes weekly data collected from outpatient influenza-like illness (ILI) visits from sentinel providers, electronic hospitalization data for pneumonia and influenza (P&I) from northern and southern California Kaiser Permanente, and positive test results for influenza and other respiratory viruses from a statewide network of 13 clinical (sentinel) laboratories and 28 public health laboratories [Respiratory Laboratory Network (RLN)]. In addition, all fatal cases of influenza under the age of 18 years are reportable. This report summarizes and provides interpretation of the data collected during the 2010–2011 influenza season (description of the pediatric fatalities is excluded to preserve confidentiality). Caution should be used in comparing the various surveillance systems, since the populations captured by the different systems are not the same (e.g. primarily inpatient, primarily outpatient, or mixed).

Summary

Compared to previous non-pandemic seasons, influenza activity in the 2010–2011 season was moderate in severity. The magnitude and time course of influenza activity was comparable to what was seen during previous non-pandemic influenza seasons.

Peak influenza clinical and laboratory activity occurred between Weeks 7–10 (February 13–March 12, 2011) (Figures 1 & 2). Subtyping results from the RLN indicated that three subtypes, influenza A (H3), influenza A (2009 H1N1), and influenza B, co-circulated and caused clinical illness throughout the season. This was in contrast to most non-pandemic seasons in the past, when influenza activity would often be characterized by one predominant subtype.

Results of laboratory testing suggested that influenza initially appeared in southern California, followed a few weeks later by northern California. Influenza B was the primary circulating virus early on, but by Week 52 (December 26, 2010–January 1, 2011), influenza A predominated.

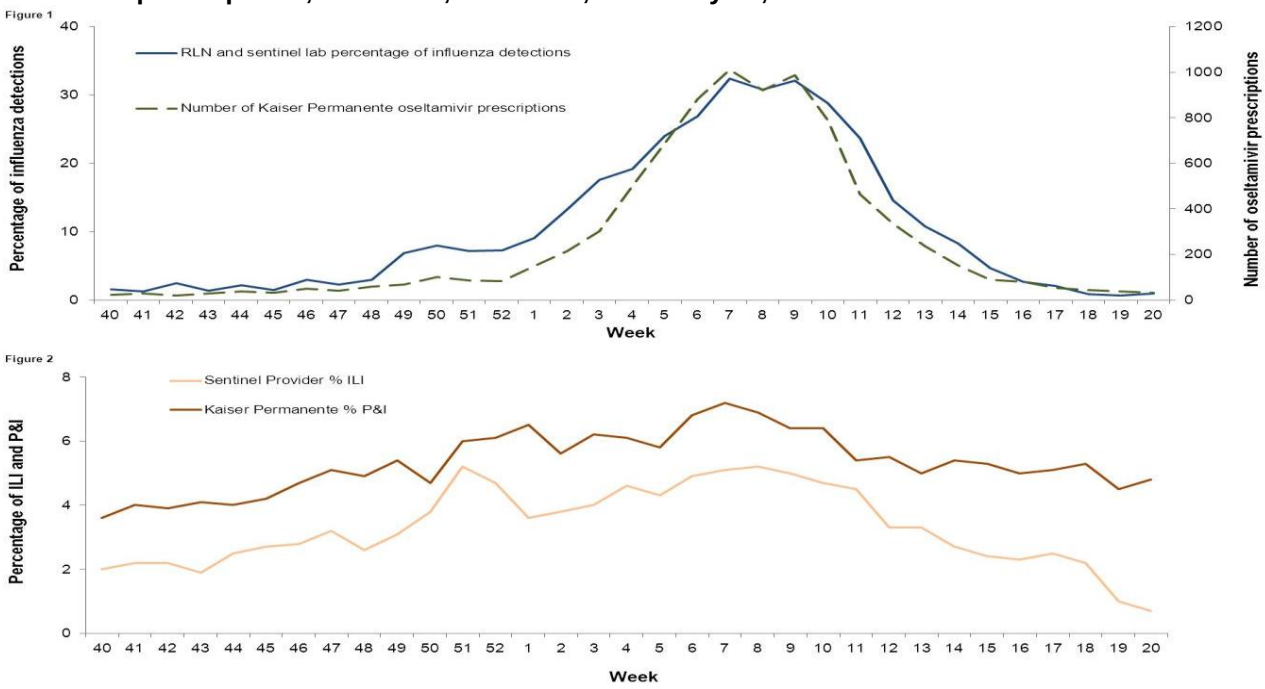
A subset of influenza specimens was strain-typed at the Centers for Disease Control and Prevention (CDC). Isolated strains were well-matched to the 2010-11 influenza vaccine. Antiviral resistance testing performed by the CDPH Viral and Rickettsial Disease Laboratory (CDPH-VRDL) on a subset of specimens identified resistance to the currently recommended antiviral drug to treat influenza, oseltamivir, in two (2%) of 95 cases. Follow up epidemiologic investigation of these cases did not identify any evidence of sustained person-to-person transmission.

Concurrent with the increase in laboratory detections for influenza, other surveillance parameters identified increased clinical activity peaking in Weeks 7–10 (February 13–March 12, 2011), with a similar pattern of progression from south to north.

For the first half of the season through Week 52 (October 3, 2010–January 1, 2011), most of the ILI reported in outpatient settings correlated with high proportions of laboratory specimens testing

positive for respiratory syncytial virus (RSV). During the same period, increased levels of KPNC hospitalizations for pneumonia and influenza were observed, first in children, then in the elderly over age 75 years in December 2010 and January 2011; these hospitalizations were likely also due to RSV.

Figures 1 & 2. Percentage of RLN/Sentinel laboratory influenza detections, Sentinel provider outpatient ILI visits, Kaiser Permanente P&I admissions and the number of Kaiser Permanente oseltamivir prescriptions, California, October 1, 2010–May 21, 2011



A. Laboratory Surveillance

CDPH obtains data on laboratory-confirmed influenza and other respiratory viruses from a number of laboratories throughout the state. These laboratories include 28 public health laboratories, collectively known as the Respiratory Laboratory Network (RLN), and 13 clinical, commercial, academic and hospital laboratories, which are referred to as sentinel laboratories.

1. Respiratory Laboratory Network (RLN) Surveillance Results

The RLN laboratories offer PCR testing for influenza A and B, including influenza A subtyping, and testing using the R-Mix shell vial culture system to identify five other common respiratory viruses (RSV, adenovirus, and parainfluenza virus type 1-3).

Of 5,718 specimens tested by the RLN from October 3, 2010 through May 21, 2011, 2,217 (38.8%) were positive for influenza; 1,590 (71.7%) were influenza A and 627 (28.3%) were influenza B (Table 1). Of the 1,590 influenza A specimens, 760 (47.8%) were A (H3) and 819 (51.5%) were A (2009 H1N1); subtyping results are pending for the remaining 11 specimens. There were no detections of non-pandemic influenza A (H1N1).

During the early part of the 2010–2011 season, influenza B was the predominant type of influenza circulating, particularly in southern California. However, by Week 52 (December 26, 2010–January

1, 2011) the proportion of influenza A detections had increased, and influenza A became the predominant type detected (Figure 3).

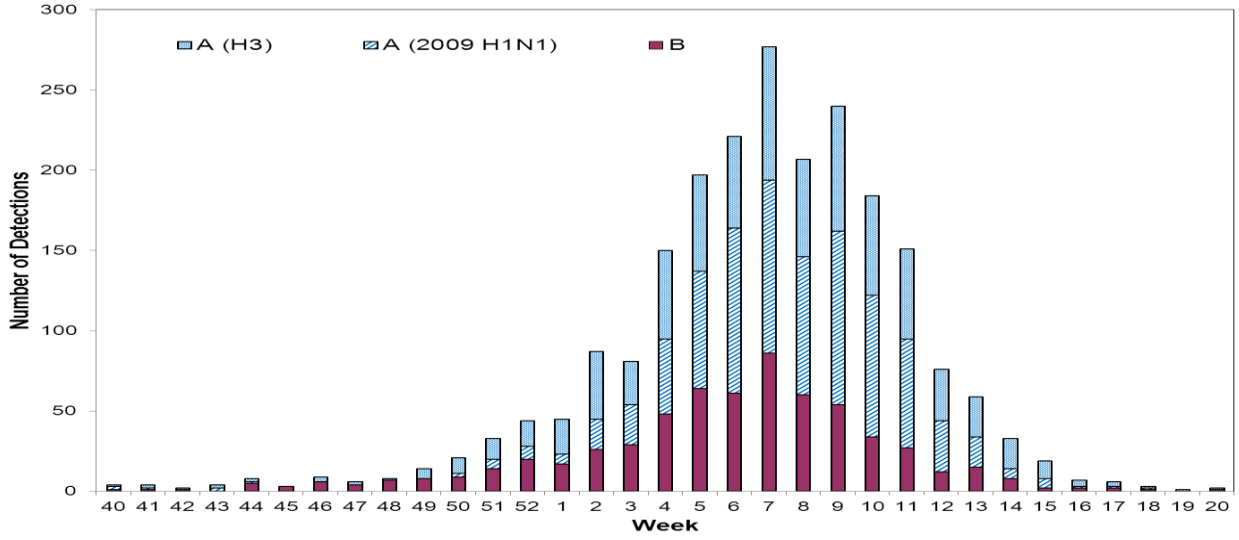
R-mix was performed on 1,087 specimens (Table 1). RSV was identified in 62 (5.7%) specimens; additional viruses detected included adenovirus (28), parainfluenza type 2 (26), parainfluenza type 3 (10), and parainfluenza type 1 (2). No influenza-RSV co-infections were reported.

Table 1. Respiratory Laboratory Network (RLN) surveillance results, October 3, 2010–May 21, 2011

	Total RLN*	Northern CA Labs	Central CA Labs	Southern CA Labs
	No. (%)	No. (%)	No. (%)	No. (%)
Number of specimens tested by PCR	**5,718**	**1,640**	**573**	**3,505**
Influenza A	1,590 (27.8)†	445 (27.1)†	170 (29.7)†	975 (27.8)†
A (seasonal H1N1)	0 (0.0)‡	0 (0.0)	0 (0.0)	0 (0.0)
A (H3)	760 (47.8)‡	187 (42.0)‡	64 (37.6)‡	509 (52.2)‡
A (2009 H1N1)	819 (51.5)‡	258 (58.0)‡	98 (57.6)‡	463 (47.5)‡
A (subtyping pending)	11 (0.7)‡	0 (0.0)	8 (4.7)‡	3 (0.3)‡
Influenza B	627 (11.0)†	71 (4.3)†	27 (4.7)†	529 (15.1)†
Number of specimens tested by R-mix	**1,087**	**43**	**585**	**459**
RSV	62 (5.7)¶	9 (20.9)¶	37 (6.3)¶	16 (3.5)¶
Other respiratory viruses	66 (6.1)¶,††	4 (9.3)¶	24 (4.1)¶	38 (8.3)¶

* Participating laboratories:
Northern California: Alameda, Contra Costa, El Dorado, Humboldt, Marin, Placer, Sacramento, San Francisco, San Mateo, Santa Clara, Shasta, Solano, Sonoma
Central California: Fresno, Monterey, Stanislaus, Tulare
Southern California: Imperial, Kern, Long Beach, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara Ventura
† Percent of total specimens tested for influenza by PCR
‡ Percent of influenza A positives
¶ Percent of total specimens tested by R-mix
†† Adenovirus (28), parainfluenza type 2 (26), parainfluenza type 3 (10), parainfluenza type 1 (2)

Figure 3. Influenza detections from RLN laboratories, by type and subtype, October 3, 2010–May 21, 2011



2. Sentinel Laboratory Surveillance Results

Sentinel laboratories are a network of 13 clinical, commercial, academic, and hospital laboratories located throughout California, and includes the Kaiser Permanente Northern California Regional

Laboratory which performs testing for over 50 medical facilities. The sentinel laboratories use various testing methods, including rapid test, direct fluorescent assay, viral culture and PCR. From October 3, 2010–May 21, 2011, the sentinel laboratories tested a total of 53,393 specimens for influenza; 8,050 (15.1%) were positive, including 5,184 (64.4%) influenza A positives and 2,866 (35.6%) influenza B positives (Table 2). The highest weekly percentage of influenza detections in the sentinel laboratories occurred during Week 9 (February 27–March 5, 2011), when 29.0% (944/3,250) of specimens were positive for influenza. Of 49,573 specimens tested for RSV by the sentinel laboratories, 9,530 (19.2%) were positive.

Table 2. Influenza and RSV detections in Sentinel Laboratories*, October 3, 2010–May 21, 2011

	No. (%)
Total specimens tested for influenza	**53,393**
Influenza A	5,184 (9.7)
Influenza B	2,866 (5.4)
Total specimens tested for RSV	**49,573**
RSV	9,530 (19.2)

* Participating laboratories: Children's Hospital Central California, Children's Hospital Los Angeles, Children's Hospital Oakland, El Centro Regional Medical Center, Kaiser Permanente hospitals, Long Beach Memorial Medical Center, Pioneer Memorial Hospital, Rady Children's Hospital San Diego, San Francisco General Hospital, San Ysidro Health Center, Stanford University Medical Center, UCLA Medical Center, UCSF Medical Center

3. Combined RLN and Sentinel Laboratory Surveillance Results

Figures 4 and 5 summarize the combined laboratory data from both the RLN and the sentinel laboratories. The overall time course and level of activity seen during the 2010–2011 season was comparable to that of previous non-pandemic influenza seasons (Figure 4). The majority of influenza detections identified by the RLN and sentinel laboratories during the 2010–2011 season were influenza A. RSV also played a prominent role in ILI during the influenza season (Figure 5).

Figure 4. Influenza detections in Respiratory Laboratory Network and Sentinel Laboratories, 2006-2011

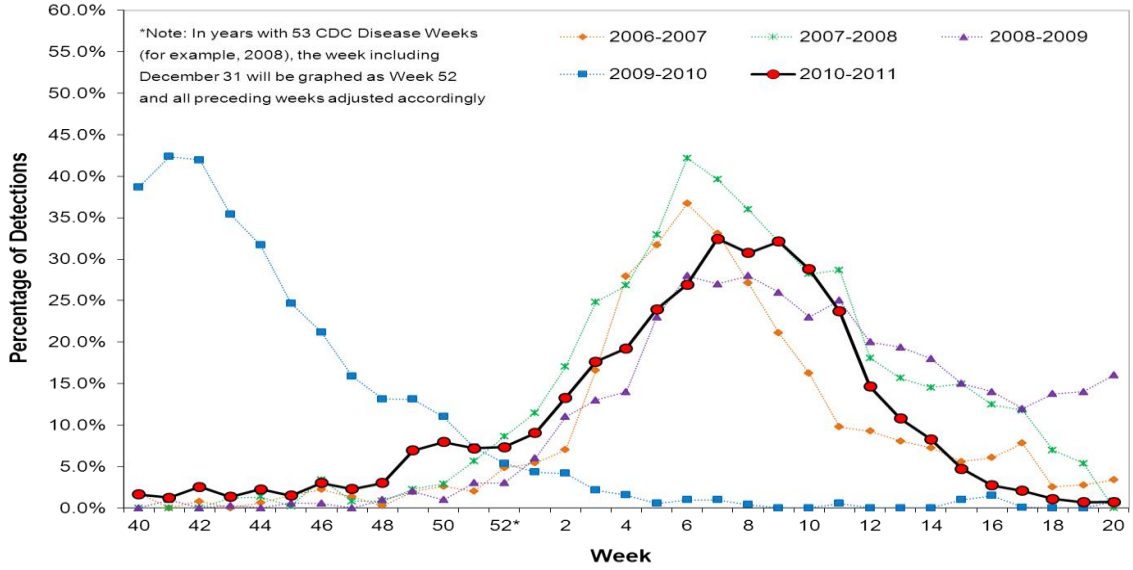
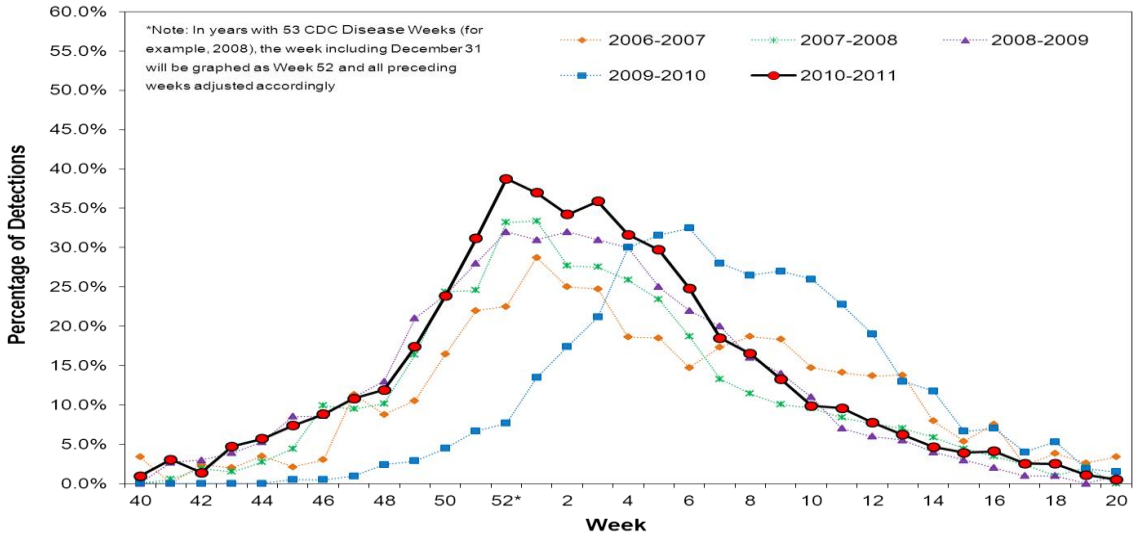


Figure 5. RSV detections in Sentinel Laboratories/Respiratory Laboratory Network, 2006-2011



4. Report on Influenza Virus Strain Characterization

CDPH-VRDL is a regional laboratory assisting with culture of isolates representing each circulating influenza virus subtype for CDC's strain typing program. Specimens that have been sent for strain typing come from sentinel providers, sentinel laboratories, local public health laboratories, outbreaks and individual cases with severe influenza.

A total of 117 specimens from California have been tested by CDC during the 2010-2011 influenza season; all but one matched with components of the 2010-2011 Northern Hemisphere influenza vaccine.

Table 3. Influenza virus antigenic characterization for the 2010-11 season

	Total (N=117)
Influenza A	90
A/Perth/16/2009-like (H3N2)*	42
A/California/07/2009-like(H1N1)*	48
Influenza B	27
B/Brisbane/60/2008-Like (Victoria lineage)*	26
B/Wisconsin/01/2010 (Yamagata lineage)	1

* Matches components of the 2010-11 Northern Hemisphere influenza vaccine

5. Antiviral Resistance Testing

Antiviral resistance testing was performed by CDPH-VRDL on a subset of specimens during the 2010–2011 influenza season. The influenza A (2009 H1N1) and A (H3) viruses were tested for a single known mutation that confers resistance to oseltamivir using both pyrosequencing and conventional sequencing. Evidence of adamantane resistance was assessed by testing another gene region for mutations using conventional sequencing. The combined data are summarized below and should be considered for epidemiological purposes only.

CDPH-VRDL tested 95 influenza A (2009 H1N1) and 63 influenza A (H3N2) specimens for antiviral resistance; 2 (2.1%) influenza A (2009 H1N1) were found to have an H275Y mutation, which

confers resistance to oseltamivir. Identification of oseltamivir resistance in influenza A/2009 H1N1 viruses is rare, but has been reported. From October 1, 2010 through May 14, 2011, 39 (of 4,229; 0.9%) cases of resistant A/2009 H1N1 viruses were identified in the US. From the emergence of influenza A/2009 H1N1 in April 2009 through May 18, 2011, 492 cases of resistance were identified worldwide.

Table 4. Number of specimens tested for antiviral resistance

	Oseltamivir Resistant	Adamantanes Resistant
Influenza A (2009 H1N1)	2/95	61/61
Influenza A (H3N2)	0/63	42/42

B. Syndromic Surveillance

1. CDC Influenza Sentinel Providers

Sentinel providers report the number of outpatient visits for influenza-like illness (ILI) and the total number of visits per week. These data are reported weekly as a percentage of total visits due to ILI. The ILI case definition is fever (temperature of 100°F [37.8°C] or greater) and a cough and/or a sore throat in the absence of a known cause other than influenza.

ILI activity levels can be classified as minimal, low, moderate, or high, and are based on the percent of outpatient visits due to ILI compared to the average percent of ILI visits that occur during spring and fall weeks with little or no influenza virus circulation. ILI activity in California remained minimal through Week 2 (January 9–15, 2011). From Weeks 3 through 6 (January 16–February 12, 2011), activity levels increased from low to moderate. After one week of high ILI activity from February 13–19, 2011, activity levels began to decrease once again, and remained at minimal levels from March 13, 2011 through the end of the season.

During the 2010–2011 influenza season, the percentage of ILI visits was typically greater in northern California compared to central and southern California. ILI activity remained low in central California until Week 3 (January 16–22, 2011), when it began increasing. During the latter part of the influenza season, higher levels of ILI activity was detected in northern and central California (Figures 6-7).

A subset of sentinel providers submitted specimens to CDPH-VRDL for influenza PCR testing. Of 369 specimens collected during the 2010–2011 influenza season; 148 (40.1%) were positive for influenza. Two-thirds of the positive specimens were collected during Weeks 4–11 (January 23–March 19, 2011), consistent with the elevated ILI activity that occurred during the same time period (Figure 8).

Figure 6. California Sentinel Providers – Influenza-like illness visits, by week of visit, 2006-2011

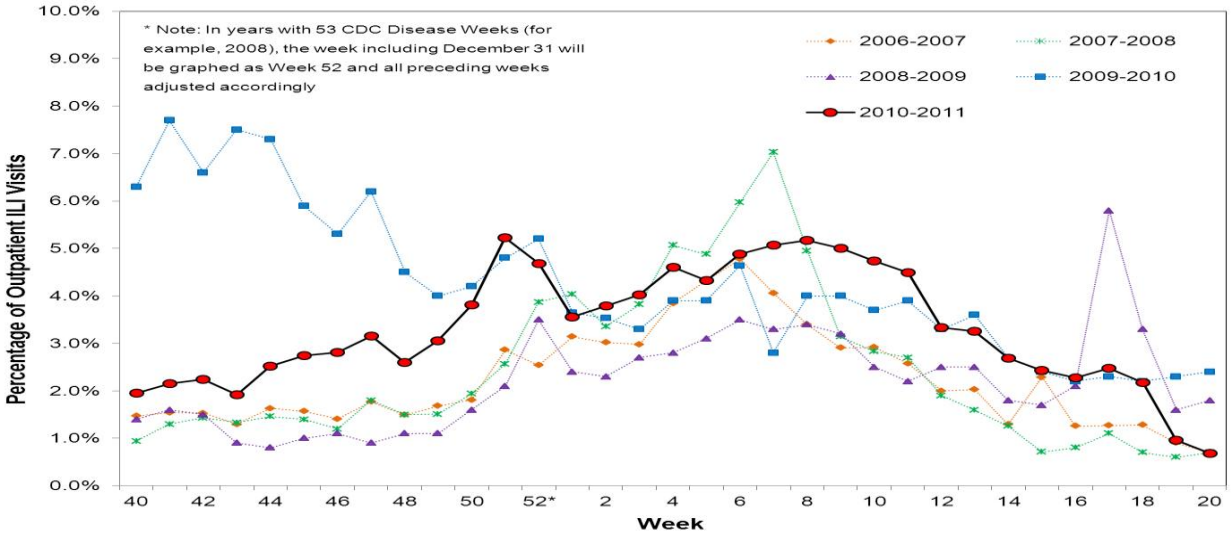


Figure 7. California Sentinel Providers – Influenza-like illness visits by region, October 3, 2010–May 21, 2011

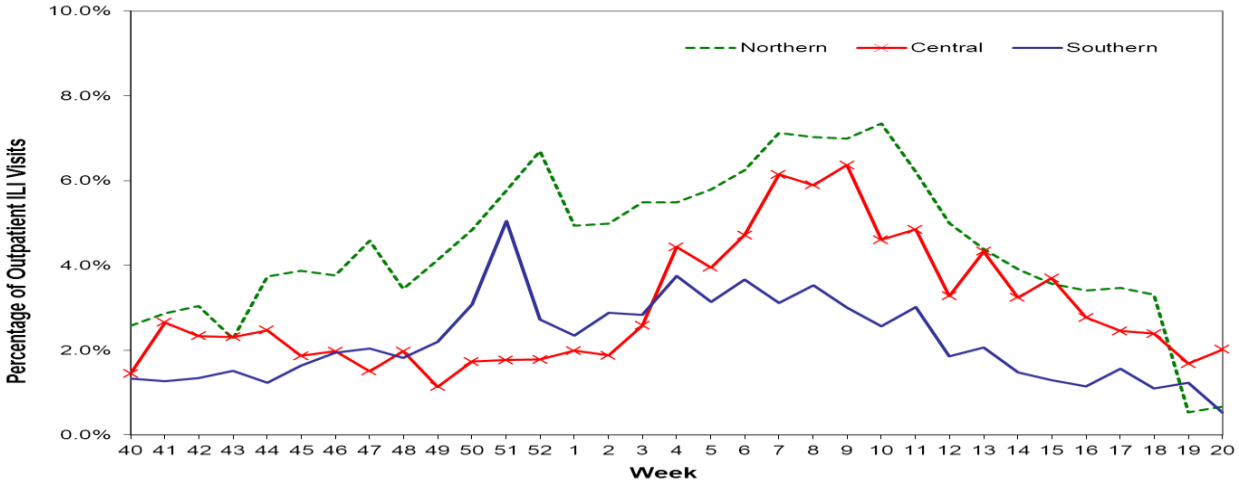
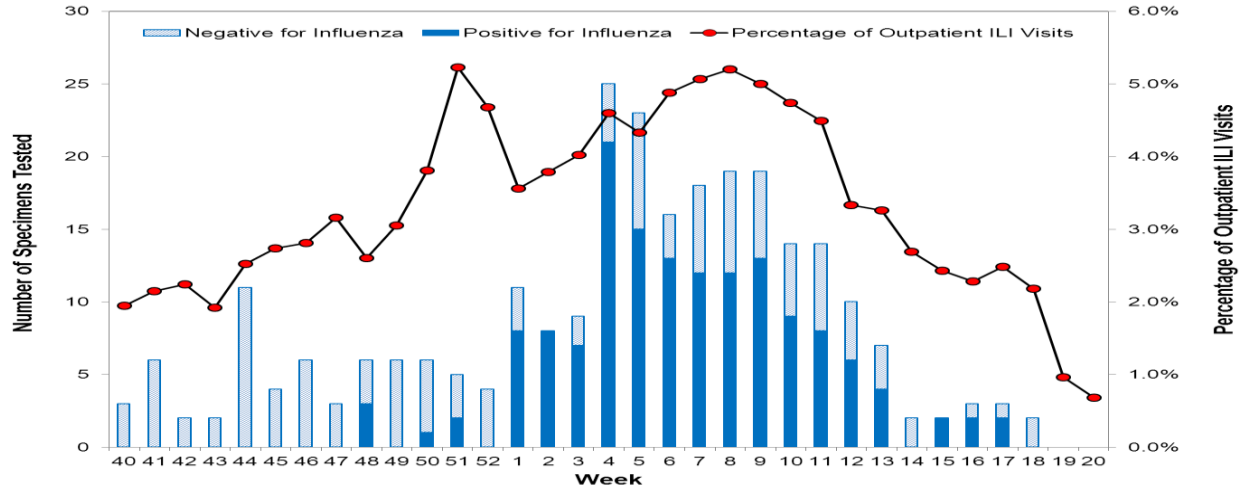


Figure 8. California Sentinel Providers – Specimens tested at CDPH-VRDL by week of collection and percentage of influenza-like visits by week of visit, October 3, 2010–May 21, 2011

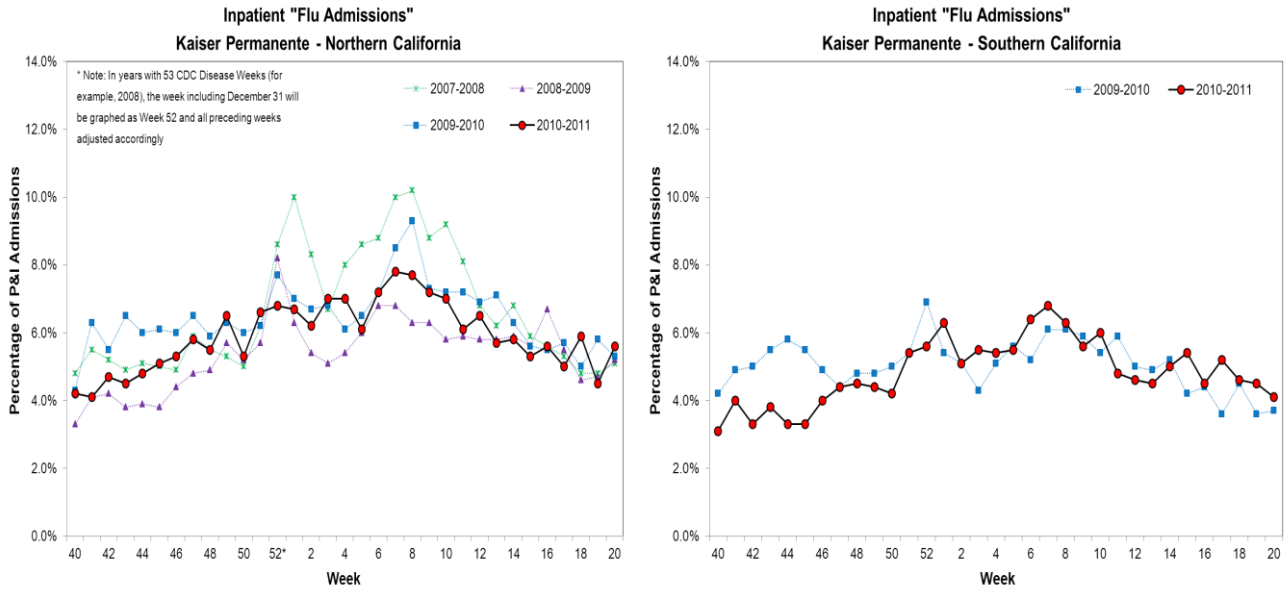


2. Kaiser Permanente Hospitalization Data ("Flu Admissions")

"Flu Admissions" are defined as a diagnosis of "flu," "pneumonia," or "influenza" recorded in text fields at time of admission to the hospital. Influenza activity is tracked by dividing the number of Flu Admissions by the total number of hospital admissions for the same day to obtain a percentage of pneumonia and influenza (P&I) admissions. Admissions for pregnancy, labor and delivery, birth, and outpatient procedures are excluded from the denominator.

The percentage of P&I hospitalizations increased steadily in both northern and southern California through the beginning of February 2011, then began decreasing. This trend is consistent with trends seen in northern California in previous years. Data prior to the 2009-2010 influenza season for southern California are not available.

Figures 9 & 10. Inpatient "flu" admissions at Kaiser Permanente facilities, 2007-2011



CDPH has implemented a pilot program monitoring the results of laboratory testing for KPNC "Flu Admit" cases. Reviewing the "Flu Admit" cases that are actually referred for influenza testing helps narrow the cases where clinicians suspect the diagnosis of viral pneumonia (compared to other suspect non-viral diagnoses that commonly fall under the umbrella of "pneumonia", such as bacterial pneumonias and congestive heart failure). From October 3, 2010–May 21, 2011, the KPNC regional laboratory tested 3,304 specimens from "Flu Admit" cases for influenza and RSV (Figure 11). RSV activity preceded influenza activity; RSV detections peaked in January 2011, compared with influenza detections, which peaked in March 2011. Of the influenza detections, influenza A was the predominant type (Figure 12).

Figure 11. Influenza and RSV detections among inpatient "flu" admissions at KPNC facilities, October 3, 2010–May 21, 2011

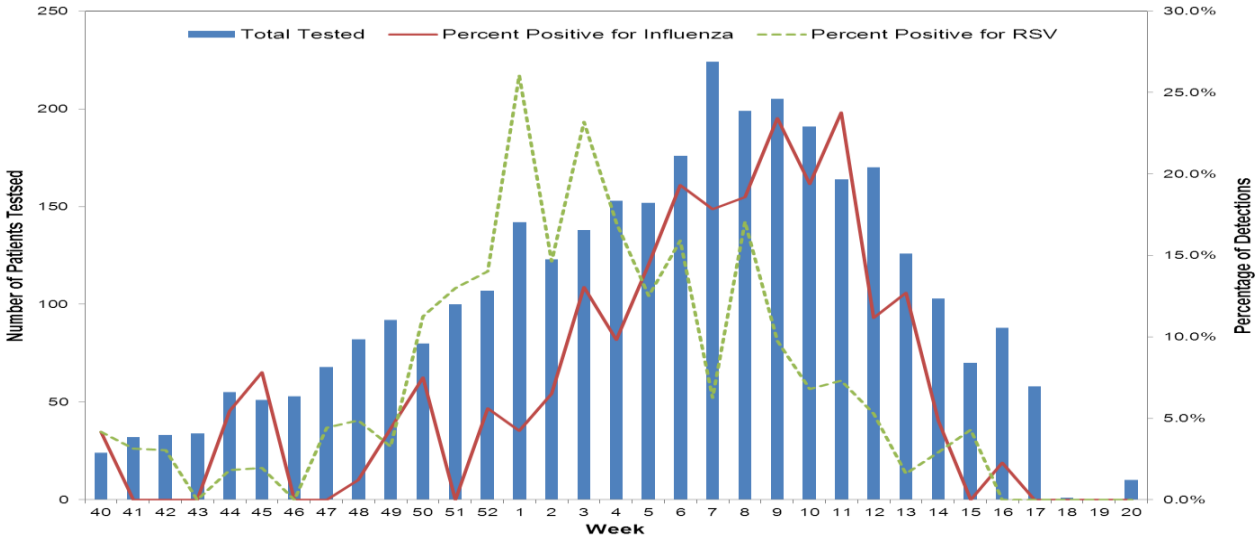
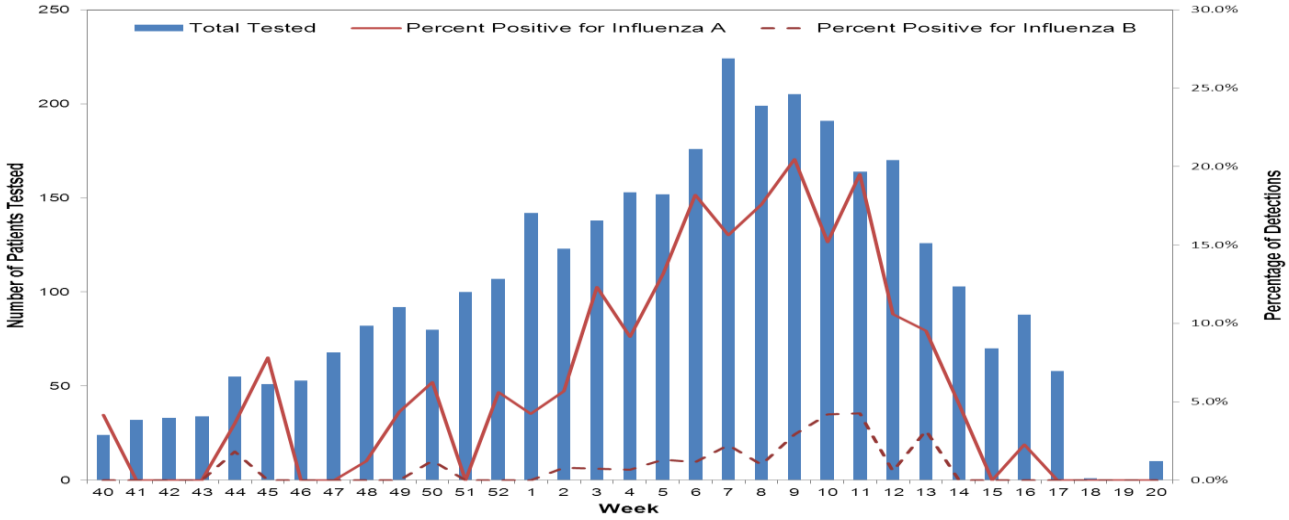


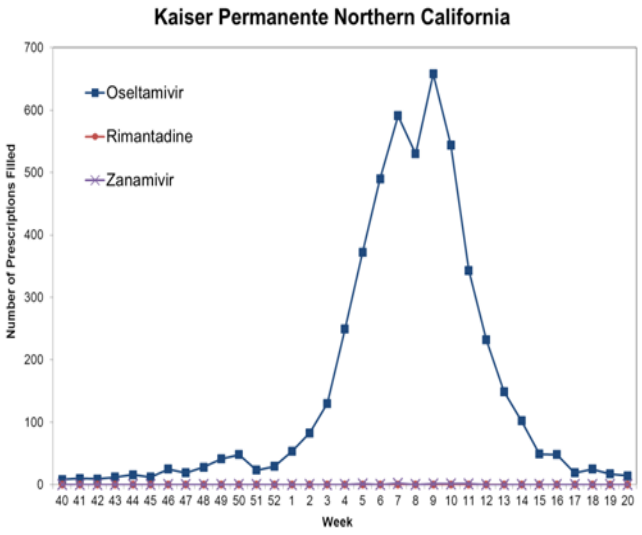
Figure 12. Influenza detections among inpatient "flu" admissions at KPNC facilities, October 3, 2010–May 21, 2011, by influenza type

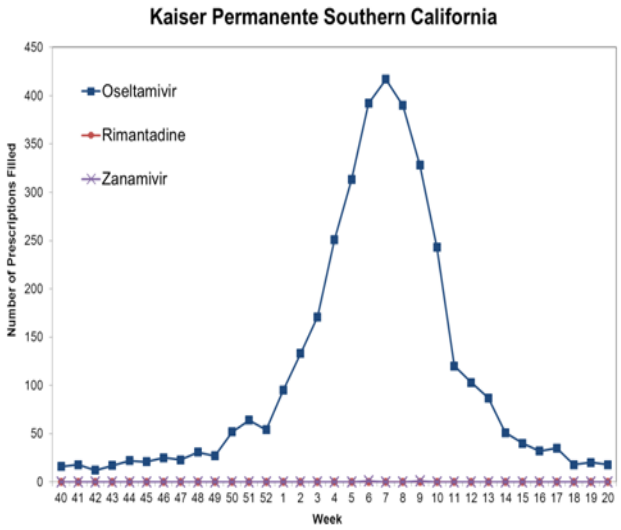


3. Kaiser Permanente Pharmacy Data

The number of outpatient prescriptions filled for rimantadine, oseltamivir and zanamivir are used to serve as indicators of influenza activity. Figures 13 and 14 show the number of influenza antiviral prescriptions filled weekly by Kaiser Permanente outpatient pharmacies in northern and southern California. The number of prescriptions for oseltamivir began to increase significantly in January 2011 in both northern and southern California, concurrent with an increase in laboratory-confirmed influenza detections. Beginning in March 2011, as influenza activity began to wane statewide, the number of Kaiser Permanente outpatient prescriptions for oseltamivir also began to decrease. It is unknown whether health care providers prescribed oseltamivir in response to an increase in patients seen with influenza-like illness, or as a result of widespread recommendations distributed by Kaiser Permanente when influenza was first confirmed laboratory testing. No prescriptions for rimantadine or zanamivir were filled during the 2010–2011 influenza season.

Figures 13 & 14. Influenza antiviral prescription utilization, Kaiser Permanente outpatients, October 3, 2010–May 21, 2011





APPENDIX A – Five regions used for influenza surveillance purposes.